Knowledge, attitudes and practices regarding the prevention of type 2 Diabetes Mellitus among overweight and obese adults in Manzini, Eswatini: A cross-sectional study.

Karen Chideme-Chinovhiringa

Thesis presented in partial fulfilment of the requirements for the degree of Master's in Health Systems and Services Research in the Faculty of Medicine and Health Sciences at Stellenbosch University.

Supervisors: Tawanda Chivese
Prof Lilian Dudley

Graduation Date; December 2020

Declaration

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Abstract

Introduction

Being overweight or obese is one of the strongest risk factors for type 2 diabetes. Eswatini has a high prevalence of undiagnosed type 2 diabetes and half of its adults are either overweight or obese. However, there is a paucity of data on knowledge, attitudes and practices towards the prevention of type 2 diabetes in people at risk in Eswatini. This study aims to assess knowledge, attitudes and practices towards the prevention of type 2 diabetes mellitus among overweight and obese adults presenting at an urban outpatient clinic in Manzini, Eswatini.

Methods

A cross-sectional study of adults who were either overweight or obese attending the clinic was carried out. Knowledge, attitudes and practices towards the prevention of type 2 diabetes mellitus were assessed using a validated researcher administered questionnaire. Knowledge, attitudes and practices were compared between overweight and obese participants. In addition, the correlation between knowledge, attitudes and practices was evaluated using a correlation matrix.

Results

A total of 105 participants, with a mean age of 35.2 (SD 10.7) years participated in the study. Of these, 55 (52.4%) and 50 (47.6%) were overweight and obese, respectively. The majority of the participants showed acceptable knowledge levels, with 61% of the participants having good knowledge and 30% excellent knowledge. Participants showed positive attitudes towards diabetes prevention, 69.5% of participants had satisfactory attitudes, 21.0% had excellent attitudes and 9.5% had neutral attitudes towards the prevention of type two diabetes mellitus. Practices were generally poor with only 33.3% meeting the World Health Organisation recommended 150 minutes of physical activity per week. Just over half (53.0%) of participants who met the criteria for screening had screened for diabetes. Dietary practices were poor with just over a third (36.2%) of participants meeting the World Health Organisation recommended daily vegetable and/or fruit intake of five servings a day and 85.7% exceeding the World Health Organisation daily recommended limit of sugar intake. There were no

significant differences between participants who were overweight and those who were obese in their knowledge, attitudes and practices towards preventing type 2 diabetes mellitus. There was a significant, positive correlation between total knowledge scores and total attitude scores ($r= 0.42$, $p<0.01$).

Conclusion

Overweight and obese adults visiting the outpatient clinic had satisfactory knowledge and attitude levels towards the prevention of type 2 diabetes. Practices towards prevention were generally poor with few participants meeting the World Health Organisation recommendations for physical activity and fruit and/or vegetable daily intake. Just over half of the eligible participants had screened for diabetes prior to the study. In addition to information, interventions are needed to motivate patients at high risk to adopt healthier dietary and physical activity practices.

Acknowledgements

I would like to thank my supervisors, Tawanda Chivese and Prof Lilian Dudley for their guidance and support on this journey. A special thank you to Tawanda for the patience, motivation especially when I felt like giving up. You always encouraged me, even when I doubted myself. Prof Dudley, thank you for your thoroughness and always identifying every mistake so I can improve the thesis.

I am grateful to the participants who took part in the study, the research assistant who assisted in data collection and entry and the translators who worked tirelessly and efficiently. I am also grateful to St Theresa's clinic management for permitting the study to take place on their premises and the clinic staff for their support.

I want to thank my family for their prayers, support and understanding - Ronald, I would not have done this without your love and support. Above all I thank the Lord Almighty for His guidance and for taking me this far.

Key Words

Type 2 diabetes mellitus, prevention, overweight, obese, adults, knowledge, attitude and practices, Eswatini

Abbreviations

BMI	Body mass index
DPP	Diabetes prevention program
GPAQ	Global physical activity questionnaire
IDF	International Diabetes Federation
KAPs	Knowledge, attitudes and practices
LMIC	Low- and medium-income countries
SEMDSA	The Society for Endocrinology, Metabolism and Diabetes of South Africa
T2DM	Type 2 diabetes mellitus
WHO	World Health Organization
WHO STEPS	World Health Organization, STEPwise approach to Surveillance (STEPS)

Table of contents

DECLARATION I
ACKNOWLEDGEMENTS IV
KEY WORDS V
ABBREVIATIONS V
TABLE OF CONTENTS VI
LIST OF FIGURES VII
LIST OF TABLES VII

CHAPTER 1 - MANUSCRIPT **1**
TITLE PAGE **1**
BACKGROUND **2**
METHODS **5**
STUDY DESIGN AND SETTING 5
STUDY POPULATION 5
STATISTICAL CONSIDERATIONS 5
DATA COLLECTION 7
ASSESSMENT OF SOCIO-ECONOMIC STATUS (SES) 8
ASSESSMENT OF KAPS 8
DATA EXTRACTION AND STATISTICAL ANALYSIS 11
ETHICAL CONSIDERATIONS 11
RESULTS **12**
SOCIO-DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS 12
KNOWLEDGE OF T2DM AND ITS PREVENTION 14
PRACTICES RELATED TO THE PREVENTION OF T2DM 18
COMPARISON OF KAPS BETWEEN OVERWEIGHT AND OBESE PARTICIPANTS 21
CORRELATION BETWEEN KAPS 22
DISCUSSION **23**
CONCLUSION **26**
COMPETING INTERESTS **26**
REFERENCES **27**
CHAPTER 2- APPENDICES **32**
APPENDIX 1. REVIEW OF RESEARCH ON KAP 32
APPENDIX 2. KAP QUESTIONNAIRE 34
APPENDIX 3. GPAQ SHOWCARDS 48
APPENDIX 4. PARTICIPANT CONSENT FORM 53
APPENDIX 5. ETHICAL APPROVAL 54

APPENDIX 6. KINGDOM OF ESWATINI (ETHICAL CLEARANCE) 56
APPENDIX 7. CLINIC APPROVAL LETTER 57
APPENDIX 8. PLOS ONE AUTHOR GUIDELINES 58

List of figures

Fig 1The Knowledge-Attitude-Practice Model ……12
Fig 2 Sources of information ……..…17
Fig 3 Ways of preventing T2DM ……..…17

List of tables

Table 1 Socio-demographic characteristics of participants……14
Table 2 Participant's knowledge about diabetes prevention ……16
Table 3 Participant's attitudes about diabetes prevention ……19
Table 4 Practices related to diabetes prevention……21
Table 5 Comparison of overweight and obese participant's knowledge, attitude and practices……22
Table 6 Correlation matrix of KAPs……..……23

Chapter 1 - Manuscript

Title Page

Knowledge, attitudes and practices regarding the prevention of type 2 Diabetes Mellitus among overweight and obese adults in Manzini, Eswatini: A cross-sectional study.

Karen Chideme-Chinovhiringa*[1], Lilian Dudley[1], Tawanda Chivese[2,3]

1.Division of Health Systems and Public Health, Department of Global Health, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa
2. Division of Epidemiology and Biostatistics, Department of Global Health, Faculty of Medicine and Health Sciences, Stellenbosch University, Cape Town, South Africa
3. Department of population medicine, College of Medicine, Qatar University, Doha, Qatar

*Corresponding author
Karen Chideme-Chinovhiringa
Address: P.O Box 7094, Manzini. Eswatini
Email: kcchino@yahoo.com
Telephone +268 76454232

Background

The International Diabetes Federation (IDF) estimated that worldwide, 463 million or 9.3% of adults aged 20-79 years were living with diabetes in the year 2019 (1). This figure is projected to rise to 700 million or 10.9% by the year 2045 (1). Type 2 diabetes mellitus (T2DM) accounts for approximately 90% of the total burden of diabetes and is preventible (1). Of concern is the fact that the burden of T2DM is disproportionately high in low-and-medium-income countries (LMIC) and is expected to increase more rapidly, in contrast to the better-resourced high-income countries (1). This rise in the prevalence of T2DM in LMIC has been attributed to ageing, increasing urbanization and obesogenic environments (1). Another concern is that around half of the people with diabetes are undiagnosed, and this proportion is higher (almost two-thirds) in African countries (1). Undiagnosed diabetes may lead to the more frequent occurrence of complications, which increases the cost of diabetes care and reduce the quality of life of affected people (2).

The Kingdom of Eswatini has a population of about 1.4 million with an adult population (20-79yrs) of 653 300 (3). According to the World Health Organization (WHO) STEPwise approach to Surveillance (STEPS) study, the prevalence of diabetes among adults in Eswatini was 14.2% and about 60.7% of diabetic adults are undiagnosed (4). The Kingdom of Eswatini has a prevalence of overweight or obesity of 50.3%, which is the third-highest in Africa with an overall obesity prevalence rate of 23.4% (5). This may imply an increase in the risk of developing diabetes in the future, driven by overweight and obesity.

Risk factors for T2DM include modifiable environmental factors such as reduced physical activity, unhealthy dietary habits, abdominal obesity, and non-modifiable factors such as age and family history (2). Excess body weight is a very important risk factor for T2DM with excess body weight present in 87% of patients with diabetes mellitus in South Africa, this is according to a systematic review of studies from South Africa (6). In addition, overweight and obesity are major risk factors for several other chronic diseases which include cardiovascular disease and cancer (7). Therefore, people who are overweight or obese may benefit from health education interventions on the prevention of T2DM and other non-communicable diseases.

The WHO defines overweight and obesity as having an abnormal or excessive fat accumulation that presents a risk to one's health (8). A crude population measure of obesity is the body mass index (BMI), defined as a person's weight (in kilograms) divided by the square of his or her height (in meters). In African populations, a BMI of between 25kg/m^2 and 30kg/m^2 is categorized as overweight, and a BMI of 30kg/m^2 or above is considered obese (8). The risk of developing T2DM has been shown to increase with an increase in BMI (9)(10). Overweight and obesity were previously considered a problem of developed countries, but presently also a major and increasing problem of LMIC countries, especially among urban populations (11). Increasing burdens of cardiometabolic diseases, driven by overweight and obesity in the LMICs, should, therefore, be anticipated.

Research has shown that lifestyle modification interventions can help prevent or delay T2DM in populations that are at high risk of developing T2DM (12). Various diabetes prevention programs in the USA, India and China have found that participants who managed to lose weight by physical exercise and healthy eating reduced their risk of T2DM. The Diabetes Prevention Program (DPP) conducted in the USA showed a 58% reduction in the risk to develop T2DM in participants with impaired glucose tolerance (13). In India, the DPP in a community based randomized control study showed that lifestyle modification resulted in a relative risk reduction of 28.5% for T2DM (14). In China, a 20 year follow up study to assess the effect of lifestyle interventions to prevent T2DM found that group-based lifestyle interventions over six years can prevent or delay the onset of diabetes by up to 14 years (15). These studies have consistently shown the benefit of identifying at-risk-populations and intervening using lifestyle modification or pharmacotherapy in preventing or delaying T2DM.

If people who are at risk of diabetes are to successfully change their lifestyles, then satisfactory levels of knowledge, attitude and practice (KAP) towards diabetes prevention are needed. However, data on whether good attitudes and levels of knowledge about diabetes prevention culminate in more prevention practices, are not conclusive. In India, one study showed that good knowledge and education were highly associated with improved care and prevention of diabetes (16). However, other researchers did not find any relationship between good knowledge and attitudes and good practices (7)(17). This remains an area where further research is clearly needed.

Several studies have assessed the impact of KAP's on the prevention of T2DM. These studies were conducted in general populations (17)(18), in patients with diabetes (7)(19) and also in select populations such as University lecturers (21). The assessment methodology of KAPs in different countries vary and no standardized tool for assessing KAPs towards the prevention of T2DM is currently available.

Worldwide, knowledge scores on T2DM ranged from a low of 19% good knowledge in Bangladesh (20) to 84% in India (21). In Africa, the knowledge scores ranged from 27% (22) in the general population in Kenya to 45% excellent knowledge among university lecturers in Nigeria (23). Attitude scores ranged from a low of 10% good attitude in Bangladesh (20) to a high of 53% good attitude in India (21). Practice scores also ranged from a low of 16% good practice in India (17) and a 33% good practice in Bangladesh (20). Interpretation and comparison of these studies are difficult due to the fact that the study populations differ and the absence of validated KAP assessment tools.

Most of the research on KAPs towards T2DM prevention focused on the general population and, to our knowledge, there are no published data on the preventative impact of KAPs specifically in overweight and obese populations. The risk for T2DM increases with increasing BMI and people who are obese are at a higher risk of T2DM compared to those who are overweight (6). Whether people who are obese tend to have better KAPs towards T2DM prevention, compared to those who are overweight is, however, not known and have not been studied.

Research on KAPs of at-risk people can inform prevention strategies and help develop targeted interventions for the at-risk groups. We found no published research on KAPs regarding the prevention of T2DM in the Kingdom of Eswatini. This study, therefore, aimed to assess the KAP's towards the prevention of T2DM in a cohort of adults who were overweight and obese attending an urban outpatient clinic in Manzini, Kingdom of Eswatini. In addition, the study explored the relationship between the participant's knowledge of T2DM, attitudes towards T2DM prevention and their practices to prevent T2DM. The KAP's between participants who were overweight and those who were obese were also compared.

Methods

Study design and setting

This cross-sectional study was conducted at a public, outpatient, catholic, health care facility. It is centrally located in the urban city of Manzini which is the second-largest city in the Kingdom of Eswatini. The clinic serves over 100 patients per day from all over Eswatini. The study was carried out from the 15th of July to the 30th of August 2019.

Study population

Participants aged between 18-79 years attending the public health care facility in Manzini were considered for inclusion in the study. For inclusion into the study, participants had to have a BMI of 25kg/m^2 or more. Patients with known diabetes mellitus, pregnant women and patients too sick to be interviewed were excluded from the study.

Statistical considerations

Sample size determination

The sample size was calculated for the primary objective of the study, which was to estimate the KAPs for the prevention of T2DM in participants who were overweight and obese. A sample size of 96 was calculated using Open Epi version 3 open source Calculator (24). The researchers anticipated that 15 600 eligible participants visited the clinic in a year. Using a design effect of one, a confidence limit of 10%, expected frequencies of 27% with good knowledge, 49% with a good attitude and 41% with good practice from a KAP study in Kenya among the general public (22), calculations yielded a sample size of 96. The sample size was increased by 10% to allow for incomplete responses.

Sampling technique

Participants were selected through a systematic sampling technique, selecting every fifth patient. This sampling interval was informed by the daily patient numbers and the proportion estimated to be overweight and obese, to allow for the recruitment of the full sample size of 100 within six weeks. Routine vital signs including height and weight were measured by a nurse after patients registered for health care services.

The BMI was calculated from these routine measurements to determine eligibility for study participation. If the selected participant did not meet the inclusion criteria, the next fifth participant was selected.

Data collection

Anthropometry

Anthropometric measurements, weight (in kilograms) and height (in meters), were repeated on participants included in the study by the researcher and BMI was again calculated. A scale and stadiometer calibrated daily were used to measure weight (to nearest whole number) and height (to two decimal places) respectively. Patients were all requested to remove footwear and any headgear for the measurements.

Questionnaire

A structured, interviewer-administered questionnaire was used to collect data (Appendix 2). The questionnaire was administered by the researcher and research assistant in either English or siSwati depending on the language the participant preferred. The English questionnaire was translated by a professional translator to siSwati through a rigorous process that ensured the same meaning was maintained. Back translations were done to ensure validity. Questions on KAPs were adapted and modified by the researcher after reviewing different literature and other questionnaires (7)(21)(25). The questionnaire was revised after a pilot study to determine the relevance and comprehensiveness of the questions was conducted with 10 participants, and through consultation with clinical staff. The results of the pilot and amendments made to the questionnaire are described in Annexure.

The siSwati questionnaire was found to be difficult for participants who chose to answer in siSwati, participants preferred to have a mix of English and siSwati during the interview. Participants commonly used the term “sugar disease” to mean diabetes, so in some instances, interviewers adapted this term to clarify diabetes mellitus when participants did not understand. The pilot study also helped to refine data entry and coding of items.

Questionnaires were administered in a private room while patients were waiting for medications at the pharmacy after completing their consultation. Study participants were asked to complete the interview which took an average of 20 minutes. After participation, patients were assisted in obtaining their medication to avoid further delays. Snacks of fruits were given to the participants at the end of the interview.

Assessment of Socio-economic status (SES)

We developed a scale on the basis of 12 item ownership in the household of the participant to reflect the standard of living. The assessment scale was adopted and modified from a previous validated wealth index scale, developed for rapid socioeconomic assessment for use by health care workers using item ownership as a measure of wealth(26). Assets included essential items such as electricity and running water, useful items such as television and radio and non-essential items included a washing machine, motor vehicle and swimming pool.

If the individual had access to 50% or more of the assets in their household, they were ranked middle SES. Having 50% or more items meant they possessed one or more of the useful and non-essential items in the list. If respondents had less than 50%, they were ranked low middle SES and they possessed mostly essential assets and just about 1 useful item.

Assessment of KAPs

Determination of knowledge of T2DM and its prevention

This section had 40 yes/no questions to assess knowledge on disease prevalence, the effect on the body, predisposing factors, signs and symptoms, and prevention. A correct response was scored 1 and incorrect scored 0. An overall knowledge score for a participant was calculated by adding scores for each question. The highest possible score was 40. The score was converted to a percentage. Participants who managed to answer at least half of the questions, 50%, were considered to have sufficient knowledge with regards to the prevention of T2DM and were classified as having good knowledge in this study. Those who scored 75% and above were regarded as having excellent knowledge towards the prevention of T2DM, however those who scored less than 50% were considered to have poor knowledge.

Determination of attitudes towards the prevention of T2DM

The section had 10 questions with a five-point Likert scale and the most appropriate response was given a score of 5 and the least appropriate was given a score of 1. Participants either agreed or strongly agreed to positive statements or disagreed or strongly disagreed with negative statements with a total possible score of 50. Attitude was classified as “very negative” if a participant scored between 0-10,

"negative" if score was between 11-20, "neutral", for 21-30, "satisfactory" for 31-40, and "excellent" for 41-50.

Determination of practices related to the prevention of T2DM

The practice section was assessed in three domains.

Domain 1: Physical activity

The physical activity of each participant was calculated based on the WHO global physical activity questionnaire (GPAQ) (27). The total number of minutes of moderately intense and vigorous exercise performed on a weekly basis by each participant was documented and included all work-related and leisure activities. Travel related physical activity was also included in calculating the total number of minutes of physical activity per week. Total physical activity was calculated by adding vigorous and moderate-intensity work-related activity, travel-related physical activity (walking included) as well as both vigorous and moderate leisure activities. The optimal recommended 150 minutes of weekly physical activity required to improve cardiovascular and metabolic health was used to define the practice of physical activity in participants as either good for those who met the WHO recommendations (>150 minutes/week) or poor for those who did not meet the WHO recommendations (< 150 minutes/week) (28).

Domain 2: Dietary practice

The second domain measured dietary practices. Daily fruit and vegetable servings were recorded as reported by participants. A serving was considered as a whole fruit or half a 250ml cup of fruits or vegetables. Consuming five or more servings of fruit and/or vegetables per day was considered a good dietary practice and consuming less than five servings was regarded as poor dietary practice (29). This domain also assessed daily sugar intake. Participants were asked how much sugar (in teaspoons) they added to their meals, in coffee, tea or other beverages. Added sugar was also determined from the amount of fizzy drink (330 ml, one glass/can), fruit juice, sugar-containing diluted drinks, and alcoholic beverages. The total daily sugar consumption in teaspoons was calculated for each participant. Poor dietary practice was recorded if the participant exceeded six teaspoons of added sugar per day and good if they consumed six or fewer teaspoons of added sugar per day as per WHO daily added sugar intake recommendations for adults (30).

Domain 3: Screening for T2DM

The T2DM screening practices of participants were assessed in this domain. Participants were asked if they had ever screened for T2DM by finger prick test for blood glucose. Screening for T2DM is recommended for high-risk individuals with a BMI of 25kg/m^2 or more with another additional risk. The Society for Endocrinology, Metabolism, and Diabetes of South Africa (SEMDSA) guidelines for the management of T2DM recommend targeted screening every three years in high-risk individuals who are overweight and have an additional risk factor (31). Additional risk factors considered in this study were:

- not meeting the WHO recommendation of 150 minutes of physical activity per week.
- hypertension
- first-degree relative with diabetes
- history of gestational diabetes
- high-risk race in this study being Asian
- age of 45 or more

The total number of participants with one or more of these additional risk factors was determined and screening practices were determined in these individuals. Screening practice was poor if the eligible participant had not screened and good if they had previously screened for diabetes.

Determination of the relationship between KAPs

The relationships between each of KAPs regarding the prevention of T2DM was assessed. Three relationships were assessed; knowledge-attitude, attitude-practices and knowledge-practices. These relationships are illustrated in Figure 1.

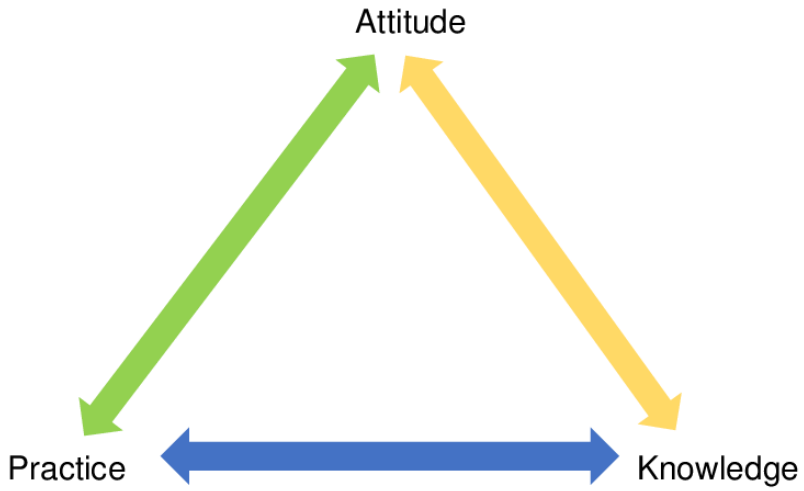


Figure 1 The Knowledge-Attitude-Practice Model (Schwartz, 1976)

The K-A-P model which is based on the cognitive-affective-behaviour theory in social psychology (32) suggests that an increase in knowledge affects attitude and consequently practices. The model is based on the notion that increasing personal knowledge will influence behavioural change (32). It is therefore hypothesized that participant's knowledge about T2DM prevention may influence the way they will develop certain attitudes and practices regarding the prevention of T2DM.

Data extraction and statistical analysis

Data was captured into *Microsoft Office Excel* using double entry. Data were cleaned and checked for missing entries and stored in a password-protected computer.
Stata version 14 (33) was used to analyse data. Frequencies and percentages were used to describe categorical data, while means and standard deviations (SD) were used to describe normally distributed numerical data. If the numerical data were not normally distributed, medians and interquartile range (IQR) were used to describe the data. For comparing categorical data, chi-square tests or Fisher's exact tests (where chi-square was not valid) were used to test for association. The Wilcoxon rank-sum test was used to compare numerical data between overweight and obese groups. A correlation matrix was also used to assess the relationship between KAP scores. We compared the KAP's between participants who were overweight and those who were obese. A p-value of 0.05 was considered statistically significant.

Ethical considerations

All participants signed informed consent before proceeding with interviews (Appendix 4). Ethical clearance to conduct this study was granted by the Health Research Ethics

Committee (HREC) of Stellenbosch University (reference # S18/08/160) (Appendix 5) and the Eswatini National Health Research Review Board (reference # SHR129/2019) (Appendix 6). The clinic management also approved the study (Appendix 7). The principles of Helsinki and Good Clinical Practice were adhered to (34).

Results

Socio-demographic characteristics of participants

Table 1 shows the socio-demographic characteristics of the participants. A total of 105 patients participated in the study and the majority (61.9%) were female. The mean age was 35.2 years (SD 10.7). Most participants (84.8%) were below the age of 45 years. Just over half (52.4%) were overweight and the remainder were obese. Almost a quarter (23.8%) of the participants were known hypertensive patients while 42.9% of the participants had a close family history of diabetes. The majority (85.7%) of participants had previously received health information on diabetes.

Table 1 - Socio-demographic characteristics of participants

Variable		***Total N=105***	
	Category	**n**	**%**
Gender	Male	40	38.1
	Female	65	61.9
Age	18-44	89	71.4
	45 and above	16	15.2
BMI class	Overweight	55	52.4
	Obese	50	47.6
Race	Black	97	92.3
	Coloured	2	1.9
	White	1	1.0
	Asian	5	4.8
Marital Status	Single	51	48.6
	Married	44	41.9
	Widowed/divorced	10	9.5
Religion	Christianity	97	92.4
	Islam	6	5.7
	None	2	1.9
Education	Primary or less	8	7.6
	Secondary	9	8.6
	High school	44	41.9
	Tertiary	44	41.9
Residence	Urban	65	61.9
	Rural	40	38.1
Income	Employed	77	73.3
	Unemployed	20	19.1
	Student	8	7.6
SES	Low	28	26.7
	Medium	77	73.3
Has hypertension,	Yes	25	23.8
History of high cholesterol	Yes	5	4.8
History of gestational diabetes in females,	Yes	4	6.2
Family history of diabetes	Yes	49	46.7
Previously had education on DM	Yes	90	85.7

**Notes: DM diabetes mellitus, SES- socioeconomic status*

Knowledge of T2DM and its prevention

The most common sources of information on diabetes reported by participants were health care workers (62.2%) and friends and family (54.4%) (Figure 2). Table 2 shows the participant's knowledge levels. Most 92(87.6%) of the participants reported knowing that diabetes was a common disease. The feet, 93(88.6%) and the eyes 89(84.8%) are the body parts most people knew were affected by diabetes. Less than half, 31(29.5%), of the participants, knew the lungs could be affected by diabetes and only 44(41.9%) knew the mouth was affected by diabetes.

Being overweight or obese was identified by 97(92.4%) as a predisposing factor for T2DM, lack of physical activity or not exercising was rightly identified by 102(97.1%) of the participants as a possible risk factor for developing T2DM. Only 43(41.0%) correctly identified mental stress as a possible risk factor for developing diabetes. A fair number of participants 68(64.8%) knew that T2DM could be prevented.

Figure 3 presents the participants' responses on the ways of preventing T2DM.

The median overall knowledge score on the prevention of T2DM was 27(IQR 25-31). When scores were classified, most (61.0%) of the participants had good knowledge, 30.5% had excellent knowledge, and only 8.6% had poor knowledge with regards to the prevention of T2DM.

There was no difference in knowledge scores between overweight and obese participants (Table 5).

Table 2 - Participants' knowledge about the effects, predisposing factors and the prevention of diabetes.

Knowledge domain/question	**Correct responses by participants N=105**	
	n	%
1. Diabetes is common these days	92	87.6
2. Parts of body affected by diabetes		
a. Eyes	89	84.8
b. Heart	69	65.7
c. Lungs	31	29.5
d. Stomach	40	38.1
e. Kidneys	85	80.9
f. Feet	93	88.6
g. Brain	71	67.6
h. Hands	66	62.9
i. Nerves	77	73.3
j. Skin	75	71.4
k. Mouth (gums and teeth)	44	41.9
3. Predisposing factors		
a. Having a family member who has/had diabetes	84	80.0
b. Having high blood pressure	79	75.2
c. Being overweight/obese	97	92.4
d. Consuming more sugar sweetened beverages such as coca cola and sweetened foods.	73	69.5
e. Staying in the same room with someone who has diabetes	103	98.1
f. Not being physically active or not exercising	102	97.1
g. Being bewitched/evil spirits	98	93.3
h. Having mental stress	43	41.0
4. Type 2 Diabetes can be prevented.	68	64.8
5. Diabetes can be treated.	22	21.0

**Responses were yes or no answers*

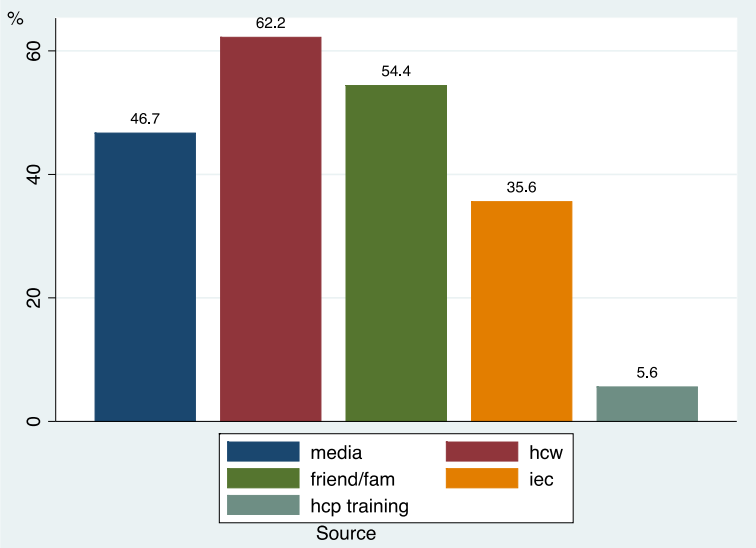


Figure 2 Participants' sources of information about diabetes. **HCP- a health care professional, HCW-health care worker, IEC-information, education and communication materials. Participants were asked to select a source of information on diabetes education.*

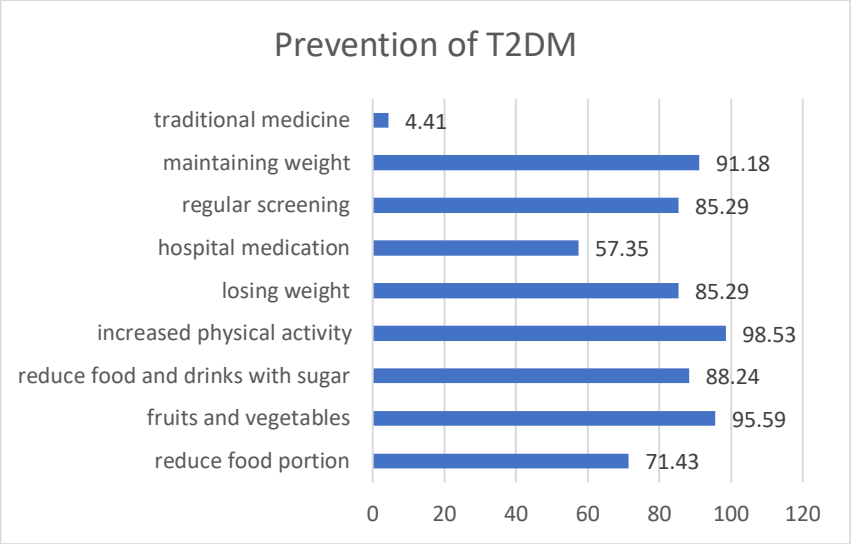


Figure 3 – Participants' knowledge about ways of preventing diabetes.
Participants were asked which of the given ways could prevent diabetes.

Attitudes towards prevention of T2DM

Table 3 shows the attitudes of participants towards diabetes prevention. Most participants (80%), either agreed or strongly agreed that their personal effort would help to control their risks of developing T2DM. Just over half of the participants, (55.2%) disagreed or strongly disagreed that they were less likely to get T2DM compared to people of the same age with normal weight. Although 55.2% felt that regular exercise and weight loss programs took a lot of effort, most participants (74.3%) believed that the benefits of weight loss and exercise outweighed the effort needed to do it.

The median attitude score was 37 (IQR 34-40), with a minimum score of 26 and a maximum of 49. The majority (69.5%) of participants had satisfactory attitudes, 21.0% had excellent attitudes and 9.5% had neutral attitudes towards the prevention of T2DM No differences in attitudes towards prevention of T2DM were observed between overweight and obese participants (Table 5).

Table 3 - Participants' beliefs and attitudes about the prevention of diabetes.

Domain Components	Participant's Responses (N = 105)				
	Strongly agree n(%)	Agree n(%)	Neutral n(%)	Disagree n(%)	Strongly Disagree n(%)
I have little control over risks to my own	4(3.8)	27(25.7)	12(11.4)	38(36.2)	24(22.9)
If I am going to get diabetes, there is nothing much I can do about it	1(1.0)	15(14.3)	16(15.2)	50(47.6)	23(21.9)
Personal efforts will help control my risk of getting diabetes	30(28.6)	54(51.4)	15(14.3)	6(5.7)	0(0.0)
People who make efforts to control risks of diabetes are less likely to diabetes mellitus	20(19.1)	60(57.1)	13(12.4)	9(8.6)	3(2.8)
I am less likely to get diabetes compared to other people of same age	6(5.7)	15(14.3)	26(24.8)	51(48.5)	7(6.7)
I am less likely to get a serious disease compared to other people of same age	2(1.9)	18(17.1)	24(22.9)	48(45.7)	13(12.4)
Doing regular exercise and following a weight loss diet take a lot of effort	21(20.0)	37(35.2)	8(7.6)	31(29.5)	8(7.6)
The benefits of following a weight loss diet and exercise program outweigh the effort to do it	13(12.4)	65(61.9)	23(21.9)	4(3.8)	0(0.0)
Regular exercise and diet may prevent diabetes from developing	26(24.8)	62(59.0)	13(12.4)	4(3.8)	0(0.0)
Diabetes mellitus can be prevented	30(28.6)	37(35.2)	18(17.1)	18(17.1)	2(1.9)

Practices related to the prevention of T2DM

Table 4 shows the participants practices towards diabetes prevention. Most minutes of physical activity were attained through moderate physical activity either at work or during leisure and walking time which had a median of 30 minutes each. Vigorous work and leisure activities both had zero median minutes. Participants with less than 50 minutes of physical activity per week were 24.8%, participants with 50 to 100

minutes per week were 26.7%, those with above 100 but less than 150 were 15.2% and 33.3% had the ideal minutes, 150 or more, of physical activity per week as recommended by WHO.

Just over a third (36.2%) of participants had good dietary practices related to fruit and vegetable intake and only 14.3% of participants had good practices towards sugar intake.

Fifty of the 105 participants (47.6%) reported that they had ever screened for diabetes. Of the 83(79.0%) participants with one or more of the six additional risk factors assessed in this study, only 44(53.0%) had ever screened for T2DM. Of the 16 participants above the age of 45 years, 11(68.8%) had ever screened for T2DM.

Table 4 – Participants' practices related to diabetes prevention

PRACTICE DOMAIN	
1. Physical activity(minutes per week)	Median (IQR)
Vigorous physical activity per week	0(0-60)
Moderate physical activity per week	40(0-90)
Walking time per week	30(15-45)
Sitting time per week	300(180-360)
Total physical activity	90(50-210)
PA minutes per week < 50	26(24.8)
50 to 100 PA minutes per week	28(26.7)
100 < PA minutes per week < 150	16(15.2)
PA minutes per week >= 150	35(33.3)
2. Diet (daily intake)	Median (IQR)
Fruits (whole fruit)	2(2-3)
Vegetables (1/2 cup)	2(1-2)
Water (litres)	1.5(1-2)
Fizzy drinks (can)	1(1-1)
Juice with added sugar(500mls)	1(0-1)
Added sugar in tea/coffee (teaspoon)	2(2-3)
Diet (Daily total intake)	
Total fruit and vegetable servings	4(3-5)
Total carbohydrate meals/day	15(13-33)
Total teaspoons sugar/day	14(12-16)
Diet (WHO daily dietary recommendations)	n(%)
Recommended daily fruit& veg intake (5 or more servings)	38(36.2)
Recommended daily sugar intake (less than 6 teaspoons)	15(14.3)
3. Screening	n(%)
Total screened for diabetes (yes)	50(47.6)
< 45 years	39(43.8)
≥ 45 years	11(68.8)
Meet criteria for screening	83(79.0)
Screened when eligible	44(53.0)
Screen result with no diabetes	50(100.0)

*Notes 1. *Total *carbohydrate meals represent the frequency of all bread, pap, rice meals.Total sugar from added sugar, fizzy drinks, juice with added sugars and beverages with added sugar. 2. A can of fizzy drink was assumed to contain 10 teaspoons of sugar, 500mls diluted juice (oros) with added sugar assumed to have 2 teaspoons of sugar. 3. Abbreviations PA- physical activity*, IQR- interquartile range

Comparison of KAPs between overweight and obese participants

Table 5 shows a comparison between overweight and obese participant's knowledge, attitudes and practices towards diabetes prevention. There was a tendency for overweight participants to have higher knowledge and attitude scores, and to be more physically active although the difference did not reach statistical significance. There were no differences in either diet or screening practices between overweight and obese participants.

Table 5 - Comparison of knowledge, attitude and practices between overweight and obese participants

	Weight categories		
	Overweight (n=55)	**Obese (n=50)**	**p-value**
Knowledge score	27(23-30)	26.5(23-32)	0.76
Attitude score	37(34-41)	37(34-39)	0.50
Practice scores			
Domain 1: Physical activity(min/wk)			
Vigorous	0(0-60)	0(0-60)	0.53
Moderate	60(0-90)	30(0-90)	0.36
Walking time	50(20-45)	30(0-30)	0.08
Total	90(70-240)	90(30-180)	0.26
Domain 2: Dietary			
Total fruit/veg servings per day	4(3-5)	4(3-5)	0.71
Total sugar teaspoons per day	13(12-16)	14(12-15)	0.94
Domain 3: Screening domain			
Participants screened n(%)	26(52.0)	24(48.0)	0.55

**Data presented as median (IQR) unless otherwise specified. Min/wk = minutes per week*

Correlation between KAPs

There was a moderate positive correlation between knowledge scores and attitude scores (r=0.42, p<0.01). Knowledge scores and the dietary practice of daily fruit and vegetable intake showed a weak positive correlation (r=0.25, p=0.01). Attitude score and the dietary practice of daily fruit and vegetable intake also showed a weak positive correlation (r=0.20, p=0.04)). There were no other significant correlations between other KAPs (Table 6).

Table 6 - Correlation matrix of KAPs

Spearman's rho	**Attitude score**	**Knowledge score**	**Physical activity minutes/wk**	**Total fruit and vegetable servings/day**	**Total teaspoons of sugar/day**
Attitude score					
Correlation coefficient	1.00				
observations	105				
significance					
Knowledge score					
Correlation coefficient	0.42	1.00			
observations	105	105			
significance	<0.01				
Physical activity minutes/week					
Correlation coefficient	0.15	0.03	1.00		
observations	105	105	105		
significance	0.14	0.80			
Total fruit and vegetable servings/day					
Correlation coefficient	0.20	0.25	-0.17	1.00	
observations	105	105	105	105	
significance	0.04	0.01	0.09		
Total teaspoons of sugar/day					
Correlation coefficient	-0.03	-0.13	-0.14	0.00	1.00
observations	105	105	105	105	105
significance	0.79	0.18	0.15	0.97	

**Spearman correlation*

Discussion

We found satisfactory levels of knowledge and attitudes in overweight and obese patients visiting the outpatient clinic. The vast majority (91.0%) of the participants had either good or excellent knowledge and satisfactory or excellent attitudes (90.5%). All the domains of practices towards the prevention of T2DM were however suboptimal. Only 33.3% met the recommended WHO 150 minutes of physical activity per week. The mean duration of exercise in the cohort was 90 minutes per week (IQR: 50-210). Just over a third (36.2%) of participants adhered to the WHO recommendation of at least five servings of fruit or vegetables per day and a mere 14% of the participants met the WHO recommendation to limit added sugar in food to six or fewer teaspoons daily. Less than half (47.6%) of all the participants screened for diabetes, and just over half 44(53%) of participants fitting criteria for screening had screened for diabetes. In those 45 years and older, 68.8% had a prior screening for diabetes. A moderate positive linear relationship was noted between knowledge and attitudes towards the prevention of diabetes.

The high knowledge scores in our study are consistent with findings from other KAP studies among non-diabetic populations in other developing countries; India, Nigeria and Sri Lanka (21)(35)(25). The high knowledge scores observed in this study may be due to the fact that the majority (85.7%) of participants had received some form of health education on diabetes previously. When sources of health information were explored, health care workers and family and friends were the most popular sources of information. The good knowledge scores may also be attributed to the advanced and developed social and media networks where information can easily be accessed and passed around on smartphones (36). These high knowledge scores suggest that current interventions in Eswatini such as providing health education appear to improve knowledge and attitudes towards the prevention of T2DM

Most participants attained satisfactory or excellent attitude scores towards the prevention of T2DM. However, only about half of participants (55%) felt they were at an increased risk of developing T2DM compared to similarly aged people of normal weight. There is a scarcity of data on the prevalence of T2DM in people who are overweight or obese from the Sub-Saharan African region. Data from a systematic review conducted in South Africa showed that excess body weight is present in 87%

of people with T2DM and stated that obesity should be regarded as a significant contributor to the high prevalence of T2DM.

Our findings of a low-risk perception amongst participants are similar to data from the Netherlands (37), where almost half of the high-risk group members were not aware of their risk for diabetes (3). A meta-analysis study on the relationship of risk perception and health behaviour showed that risk perception is linked to health behaviour change(39) and that people are motivated to adjust health behaviour when they realize they are at risk. The low risk perception in our study may be one of the reasons why the practices towards T2DM prevention were poor. Interventions aimed at increasing T2DM risk perception among people who are overweight or obese may help in improving practices, although research evidence is needed.

According to the health belief model, high knowledge translates to positive attitudes. In this study, the positive correlation between knowledge and attitude is supported by the theory from the K-A-P model which is based on the cognitive-affective-behaviour theory in social psychology. This model also suggests that an increase in knowledge affects attitude and consequently practices. The model is based on the notion that increasing personal knowledge will influence behavioural change (32).

We found that the high levels of knowledge and attitudes did not translate to good practices, contrary to the K-A-P model assumption (32). Practices related to diabetes prevention were poor and in keeping with other studies (7)(17). Less than half of the participants had good practices in all three domains assessed. Only 33.3% met the recommended WHO 150 minutes of physical activity per week. This proportion is much less than that reported in the WHO STEPS study carried out in Eswatini in 2015 where 84.7% of respondents met the WHO recommendations of physical activity (4). A key difference between our study and the WHO STEPS study is that the latter assessed practice in the general population compared to our high-risk group. Our findings could be partly explained by research findings indicating that overweight and obese individuals have lower physical activity, compared to those of normal weight (40). The link between attitudes and practices is seen in that more than half of the participants believed that exercise and a weight loss diet takes a lot of effort. This shows that extra motivation will be needed to improve practices in this domain. On the other hand, this could be viewed as positive as participants who do not expect changes

to happen without effort will not be easily discouraged. Research on interventions that help improve both diet and physical activity in those who are overweight or obese in our setting or similar settings, is needed since research is scarce in this area.

Practices related to diet were particularly poor overall. Just over a third (36.2%) of participants adhered to the WHO recommendation of at least five servings of fruit or vegetables per day. This is more compared to the 2015 WHO Steps study carried out in Eswatini which reported only 7.9%(CI:6.4-9.5) (4). The majority, 86% of the participants did not meet the WHO recommendation to limit added sugar intake to six or fewer teaspoons daily, their addeded sugar intake was more than the daily recommendation. This may be related to the participants consuming the “hidden” sugar in sugar-sweetened beverages. To our knowledge, there is no research on consumer’s knowledge of the components of the foods they consume and on whether food labelling has improved this, in Eswatini. It is possible that the participants consumed sugar while being unaware of how much they consumed.

Just over half of the participants with an additional risk factor reported that they had screened for diabetes. When participants feel they are not at risk of diabetes, they are less likely to screen for the disease. A study in South West Nigeria recorded a very low screening practice among university staff, it observed that only 66(23.6%) out of 300 participants had ever screened for diabetes (35). We found that the majority of the participants who were over the age of 45 years had previously screened for T2DM, but a small proportion of participants of our cohort fell into this age category. It was pleasing to note that older adults attending a health facility are being screened, suggesting that the facilities are being vigilant in screening older clients though there is room to improve.

Several studies have shown that the risk of developing T2DM increases with the degree of excess body weight (6)(10). BMI was found to be a predictor of weight control advice and counselling on lifestyle adjustment in primary health care settings by health care providers (41). Obese participants, as the higher risk category compared to those who are overweight are thus expected to have received health education at clinic visits which should result in higher knowledge levels, attitudes and subsequently better practices. Our study did not find any statistical difference in knowledge, attitudes, and practices between the two weight categories.

The small sample size of this study limits the conclusions that can be drawn from the findings. More rigorously designed studies with larger sample sizes are recommended to build upon findings from this study. Due to a paucity of similar research in this field, tools and assessment criteria have not been validated in other research. As the questionnaires used to evaluate knowledge and assess attitude have not been validated, they can be improved upon and should be tested in larger patient populations. We, however, conducted a pilot study to assess instrument reliability and internal validity. Another limitation of this study is that physical activity and dietary information were self-reported. Diet is a particularly difficult concept to assess, even with a validated food frequency questionnaire. We did not assess carbohydrate, protein and fat intake in calories/ kilojoules which would have given a more comprehensive assessment of total food intake. Physical activity is better assessed with accelerometers, which tend to be expensive. Qualitative research may help to explain why good knowledge and attitudes did not translate into better practices. Research on the proportion of people who are overweight or obese that develop T2DM is needed as well as context-specific diabetes prevention programs relevant to our setting.

Conclusion

We found acceptable levels of knowledge and attitudes, but generally poor practices towards the prevention of T2DM among overweight and obese adults attending an outpatient clinic in Manzini, Eswatini. More research is needed to explore why the good levels of knowledge and attitudes observed did not translate to good practices towards the prevention of T2DM so as to improve practices related to the prevention of T2DM in high-risk groups. Additional interventions aimed at increasing T2DM risk perception among people who are overweight or obese may also `help in improving practices, as well as interventions to improve motivation to initiate and sustain new behaviours in this setting.

Competing interests

None declared.

References

1. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. Diabetes Research and Clinical Practice. 2019 Nov 1;157..DOI:https://doi.org/10.1016/j.diabres.2019.107843.
2. Mayor S. International Diabetes Federation consensus on prevention of type 2 diabetes. International Journal of Clinical Practice. 2007 Oct;61(10):1773-5. http://doi.wiley.com/10.1111/j.1742-1241.2007.01547.x
3. Building Resilience for Peace and Food Security The State of Food Security and Nutrition in the world 2017. [cited 2020 Feb 1]. Available from: www.fao.org/publications
4. Swaziland Ministry of Health. Swaziland Noncommunicable Disease Risk Factor Surveillance Report. 2015; Available from: http://www.who.int/chp/steps/Swaziland_2014_STEPS_Report.pdf
5. Yatsuya H, Li Y, Hilawe EH, Ota A, Wang C, Chiang C, Zhang Y, Uemura M, Osako A, Ozaki Y, Aoyama A. Global trend in overweight and obesity and its association with cardiovascular disease incidence. Circulation Journal. 2014:CJ-14.
6. Joubert J, Norman R, Bradshaw D, Goedecke JH, Steyn NP, Puoane T. Estimating the burden of disease attributable to excess body weight in South Africa in 2000. South African Medical Journal. 2007;97(8):683–90
7. Okonta HI, Ikombele JB, Ogunbanjo GA. Knowledge, attitude and practice regarding lifestyle modification in type 2 diabetic patients. African Journal of Primary Health Care and Family Medicine. 2014;6(1):2–7.
8. World Health Organization. Obesity.2007 [cited 2017 Aug 12]. Available from: http://www.who.int/topics/obesity/en
9. Ganz ML, Wintfeld N, Li Q, Alas V, Langer J, Hammer M. The association of body mass index with the risk of type 2 diabetes: a case–control study nested in an electronic health records system in the United States. Diabetology & metabolic syndrome. 2014 Dec;6(1):50.

10. Krishnan S, Rosenberg L, Djoussé L, Cupples LA, Palmer JR. Overall and central obesity and risk of type 2 diabetes in US black women. Obesity. 2007 Jul;15(7):1860-6.
11. World Health Organization. Diabetes Factsheet. WHO Media centre. http://www.who.int/mediacentre/factsheets/fs312/en/. 2012.
12. Haw JS, Galaviz KI, Straus AN, Kowalski AJ, Magee MJ, Weber MB, Wei J, Narayan KV, Ali MK. Long-term sustainability of diabetes prevention approaches: a systematic review and meta-analysis of randomized clinical trials. JAMA internal medicine. 2017 Dec 1;177(12):1808-17.
13. Diabetes Prevention Program Research Group. 10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program Outcomes Study. The Lancet. 2009 Nov 14;374(9702):1677-86.
14. Ramachandran A, Snehalatha C, Mary S, Mukesh B, Bhaskar AD, Vijay V. The Indian Diabetes Prevention Programme shows that lifestyle modification and metformin prevent type 2 diabetes in Asian Indian subjects with impaired glucose tolerance (IDPP-1). Diabetologia. 2006 Feb 1;49(2):289-97.
15. Li G, Zhang P, Wang J, Gregg EW, Yang W, Gong Q, et al. The long-term effect of lifestyle interventions to prevent diabetes in the China Da Qing Diabetes Prevention Study: a 20-year follow-up study. Vol. 371, The Lancet. 2008. p. 1783–9.
16. Rani PK, Raman R, Subramani S, Perumal G, Kumaramanickavel G, Sharma T. Knowledge of diabetes and diabetic retinopathy among rural populations in India, and the influence of knowledge of diabetic retinopathy on attitude and practice. 2008;8(3):838. Available from: http://www.ncbi.nlm.nih.gov/pubmed/18656993
17. Rathod GB, Rathod S, Parmar P, Parikh A. Study of Knowledge, Attitude and Practice of General Population of Waghodia Towards Diabetes Mellitus. International journal of current research and review. 2014;06(01):63–8.
18. Kassahun CW, Mekonen AG. Knowledge, attitude, practices and their associated factors towards diabetes mellitus among non diabetes community members of Bale Zone administrative towns, South East Ethiopia. A cross-sectional study. PloS one. 2017;12(2).

19. Gautam A, Bhatta DN, Aryal UR. Diabetes related health knowledge, attitude and practice among diabetic patients in Nepal. BMC endocrine disorders. 2015 Dec;15(1):25.
20. Fatema K, Hossain S, Natasha K, Chowdhury HA, Akter J, Khan T, Ali L. Knowledge attitude and practice regarding diabetes mellitus among Nondiabetic and diabetic study participants in Bangladesh. BMC Public Health. 2017 Dec;17(1):364
21. Sharma S. Diabetes Prevention in Nepal: Assessment of Knowledge and Attitude of the 40+ Patients. Journal of Advanced Academic Research. 2014;1(1):46-52.
22. Kiberenge MW, Ndegwa ZM, Njenga EW, Muchemi EW. Knowledge, attitude and practices related to diabetes among community members in four provinces in Kenya: a cross-sectional study. The Pan African Medical Journal. 2010;7:2.
23. Asekun-Olarinmoye E., Adebimpe W., Omisore O. Knowledge, attitude and practice towards screening and risk factors for diabetes mellitus among staff of a University of southwestern Nigeria. Niger Endocr Pract. 2011;5(2):19–25.
24. OpenEpi | StatCalc | User Guide | Support | Epi Info™ | CDC [Internet]. CDC; Available from: https://www.openepi.com/Menu/OE_Menu.htm
25. Herath HM, Weerasinghe NP, Dias H, Weerarathna TP. Knowledge, attitude and practice related to diabetes mellitus among the general public in Galle district in Southern Sri Lanka: a pilot study. BMC Public Health. 2017 Dec 1;17(1):535.
26. Patel AB, Prabhu AS, Dibley MJ, Kulkarni LR. A tool for rapid socioeconomic assessment. Indian Journal of Pediatrics. 2007;74(4):349–52.
27. World Health Organization. Global Physical Activity Questionnaire (GPAQ) WHO STEPwise approach to NCD risk factor surveillance. Surveillance and Population-Based Prevention, Prevention of Noncommunicable Diseases Department. 2008;1–3. Available from: http://www.who.int/chp/steps/GPAQ_EN.pdf

28. World Health Organization. Global recommendations on physical activity for health.; 2010. http://dx.doi.org/10.1080/01422419908228843
29. World Health Organization. Healthy Diet Healthy Diet Fact Sheet N394. 2015. p. 1–6. Available from: http://www.who.int/mediacentre/factsheets/fs394/en/
30. World Health Organisation. Guideline: Sugars intake for adults and children. World Health Organization 2018 [cited 2020 Feb 1];57(6):1716–22. Available from: http://link.springer.com/10.1007/s10773-018-3697-3
31. Amod A, Coetzee A, Kinvig TE. SEMDSA 2017 Guidelines for the management of Type 2 diabetes mellitus. JEMDSA. 2017;22(1):S1-96.
32. Schwartz NE. Nutrition knowledge, attitudes and practices of Canadian public health nurses. Journal of Nutrition Education. 1976 Jan 1;8(1):28-31.
33. Stata Corporation. Stata Statistical Software: Release 14. TX:StataCorp LP. 2015.
34. Holm S. Declaration of Helsinki. International encyclopedia of ethics. 2013 Jan 16.
35. Naam K, Tipe M, Mc M, Fakulteitsekretaris L, Navrae DIER, Tel L, et al. Knowledge, attitude and practice towards screening and risk factirs for diabetes mellitus among staff of a University of southwestern Nigeria. BMC Public Health 2014;2(1):1–10.
36. Levac JJ, O'Sullivan T. Social Media and its Use in Health Promotion. Revue interdisciplinaire des sciences de la santé - Interdisciplinary Journal of Health Sciences. 2010;1(1):47.
37. Adriaanse MC, Twisk JW, Dekker JM, Spijkerman AM, Nijpels G, Heine RJ, Snoek FJ. Perceptions of risk in adults with a low or high risk profile of developing type 2 diabetes; a cross-sectional population-based study. Patient Education and Counseling. 2008 Nov 1;73(2):307-12.
38. Weber Cullen K, Buzek BB. Knowledge About Type 2 Diabetes Risk and Prevention of African-American and Hispanic Adults and Adolescents With Family History of Type 2 Diabetes. The Diabetes Educator. 2009;35(5):836–42. Available from: http://journals.sagepub.com/doi/10.1177/0145721709341851
39. Brewer NT, Chapman GB, Gibbons FX, Gerrard M, McCaul KD,

Weinstein ND. Meta-analysis of the relationship between risk perception and health behavior: The example of vaccination. Health Psychology. 2007;26(2):136–45.

40. Mayer-Davis EJ, Costacou T. Obesity and sedentary lifestyle: modifiable risk factors for prevention of type 2 diabetes. Current diabetes reports. 2001 Oct;1(2):170–6. Available from: http://link.springer.com/10.1007/s11892-001-0030-x
41. Pippitt K, Li M, Gurgle HE. Diabetes mellitus: screening and diagnosis. American Family Physician. 2016 Jan 15;93(2):103-9.
42. Siu AL. Screening for abnormal blood glucose and type 2 diabetes mellitus: US Preventive Services Task Force recommendation statement. Annals of Internal Medicine. 2015 Dec 1;163(11):861-8.
43. Baleta A, Mitchell F. Country in Focus: diabetes and obesity in South Africa. The Lancet Diabetes & Endocrinology. 2014 Sep 1;2(9):687-8.

Chapter 2- Appendices

Appendix 1. Review of research on KAP

Table 7: Research Studies on KAP on Prevention of T2DM in Developing Countries

Title of Study	Author, year	Country	Sample size and At-risk-definition (IGT/ IFG/ Overweight/ Obese/ GDM)	Study design	Findings	Comments
Study of Knowledge, Attitude and Practice of general population of Waghodia towards Diabetes Mellitus	Rathod GB, Rathod S, Parmar P, Parikh A (2014)	Waghodia, India	570 general population	Cross sectional	56.14 % scored 100% in knowledge questions.17.58% scored 100% in attitude questions and15.78% scored 100% in practice questions.	Continuing reinforcement motivation and health education will bring about positive changes in practices.
Knowledge, attitude and practice towards screening and risk factors for diabetes mellitus among staff of a University of southwestern Nigeria.	Asekun-Olarinmoye A et al (2011)	Nigeria	280 University staff	Cross-sectional	Good Knowledge-45.4% Excellent Attitude-43.9%	There is need to increase community awareness of diabetes screening and control.
Knowledge, attitude and practices related to diabetes among community members in four provinces in Kenya	Maina.WK ,&, Ndegwa.ZM et al (2010)	Kenya	1982-General population	Cross sectional	Good Knowledge-27.2% Good Attitude-49% Good Practices-41%	Results showed poor KAP nationwide, recommended comprehensive diabetes education
Knowledge, attitude and practice related to diabetes mellitus among the general public in Galle district in	Herath.H, Weerasinghe. N &Weerarathna T (2017)	Sri Lanka	277-General population	Cross-sectional	Above moderate knowledge= 77%, Poor attitude= 90% Poor practice on preventive measures over 50%	KAP was poor and more had to be done to ensure the general population received education on T2DM

Southern Sri Lanka						
Diabetes Prevention in Nepal: Assessment of Knowledge and Attitude of the 40+ Patients	Saraswati Sharma (2014)	India	100 ,40year+ adults	Cross sectional study	Good Knowledge on prevention- 84% , good Attitude- 53.06%	Study concluded that risk of diabetes will increase due to the available lifestyles, diet ad sedentary practices thereby making prevention of this disease very important
Knowledge attitude and practice regarding diabetes mellitus among Non-diabetic and diabetic study participants in Bangladesh	Fatema. K, Hossain. S et al (2017)	Bangladesh	18,697 adults (aged 18 years and above; 7796 male and 10,901 female; 6780 non-DM and 11,917 T2DM)	Cross sectional	Among non diabetics, good Knowledge- 19%, good Attitude- 10%, good Practice- 33%	The KAP regarding diabetes was found to be better among people who were living with diabetes compared to non diabetics
Exploring knowledge , attitudes and practices related to diabetes in Mongolia : a national population-based survey	Demaio. AR &Otgontuya. D et al (2013)	Mangolia	3540 households with one member aged 15-64yrs interviewed	Cross sectional	No Knowledge on prevention- 33% Poor Knowledge- 50%	Low knowledge of diabetes, Health education should be part of any national strategy for diabetes

Appendix 2. KAP Questionnaire

Participant code	

Questionnaire on Knowledge, attitudes and practices with regards to prevention of type 2 Diabetes Mellitus (T2DM) among overweight and obese adults.

Part A: Socio- Demographic data

Read: I would like to ask you questions related to your personal, social and medical history.

SECTION 1: GENERAL INFORMATION

Participant study number: ……

Participant suburb of residence……

Consent has been read and obtained? Yes, if yes continue

No, if no, STOP

Date of interview:

D D M M Y Y Y Y

Age of participant at last birthday……

Participant gender: Male ……1 Female…..2 Other 3

Height----------(m) Weight----------(kg) Waist circumference----------

Hip circumference----------(cm) BMI

SECTION 2: SOCIO-DEMOGRAPHIC INFORMATION

	QUESTIONS AND FILTERS		CODING CATEGORIES
2A	What is the highest level of education that you have achieved?		
		No school	1
		Primary school	2
		Secondary school	3
		High school	4
		Tertiary education	5
2B	What do you do for work or income?	Employed, salaried	1
		Self-employed	2
		Unemployed	3
		A full-time homemaker	4
		A pensioner	5
		On a grant	6
		A student	7
2C	What is your religion?	Christianity	1
		Islam	2
		Hindu	3
		Baha'i	4
		Traditional	5
		None	6
		Other	7
2D	What ethnicity do you identify yourself as?	Black	1
		Coloured	2
		White	3
		Asian	4
		Other	5
2E	Are you…….	Single	1
		Married(civil/traditional)/ live in partner	2
		Widowed	3

	QUESTIONS AND FILTERS		CODING CATEGORIES
		Divorced/Separated	4
2F	Does your household have:	YES	NO
	Electricity?	1	0
	A radio?	1	0
	A television?	1	0
	A landline?	1	0
	A cellphone	1	0
	A refrigerator?	1	0
	A microwave?	1	0
	A personal computer (PC)?	1	0
	A washing machine?	1	0
	Access to tap water?	1	0
	A motor car?	1	0
	Swimming pool?	1	0

SECTION 3: MEDICAL HISTORY

	Has a **doctor** or **nurse** or **health worker** at a **clinic** or **hospital told you** that you have or have had any of the following conditions:			
3A	High Blood Pressure?	YES…1	NO…0	DON'T KNOW…9
3B	Diabetes during pregnancy (this usually goes away after the pregnancy)	YES…1	NO…0	DON'T KNOW…9
3C	Pre- diabetes	YES…1	NO…0	DON'T KNOW…9
3D	Diabetes	YES…1	NO…0	DON'T KNOW…9
3E	High blood cholesterol or fats in the blood?	YES…1	NO…0	DON'T KNOW…9

SECTION 4: FAMILY MEDICAL HISTORY

	Now I would like to ask you about your family. Do you have a close blood relative (father, mother, brother, sister or child) who has ever been diagnosed by a doctor or nurse with any of the following conditions?			
4A	High Blood Pressure?	YES…1	NO…0	DON'T KNOW…9
4B	Gestational diabetes? (Diabetes during pregnancy (this usually goes away after the pregnancy)	YES…1	NO…0	DON'T KNOW…9
4C	Diabetes?	YES…1	NO…0	DON'T KNOW…9

SECTION 5: INFORMATION ON DIABETES

5A	Have you ever been told about diabetes?	YES…1	NO…0
5B	If yes, who told you?(tick all applicable)	Media (tv, radio, social media, phone)	1
		Medical personnel (nurse, doctor or any medical practitioner)	2
		Friends / family	3
		Health promotion material (pamphlets, charts, bill boards)	4
		Am a health care worker	5

Part B: Knowledge, Attitude and Practice Questions

I would like to ask you questions with regards to knowledge of diabetes mellitus. These questions refer to the way you understand the disease.

SECTION 6: KNOWLEDGE OF TYPE 2 DIABETES AND ITS PREVENTION

QUESTIONS AND FILTERS		Response and Score		
6A	Have you ever heard of a condition called diabetes mellitus?	YES …1	NO… 0	
6B	Do you think in general; more people are being affected with diabetes these days?	YES … 1	NO….0	DON'T KNOW…0
6C	Which of the following parts of the body you think may be affected diabetes mellitus?	YES	NO	
	Eyes	1	0	
	Heart	1	0	
	Lungs	1	0	
	Stomach	1	0	
	Kidneys	1	0	
	Feet	1	0	
	Brain	1	0	
	Hands	1	0	
	Nerves	1	0	
	Skin	1	0	
	Mouth- gums and teeth	1	0	
6D	Which of the following would you consider to make someone develop diabetes mellitus more easily compared to others?	YES	NO	
	Having a family member who has or had diabetes	1	0	
	Having high blood pressure	1	0	
	Being overweight/ obese	1	0	
	Consuming more sugar sweetened beverages such as coca cola and sweetened foods	1	0	

QUESTIONS AND FILTERS		Response and Score		
	Staying I the same room with someone who has diabetes	0	1	
	Not being physically active or not exercising	1	0	
	Being bewitched/ evil spirits	0	1	
	Having mental stress	1	0	
6E	Which of the following are signs or symptoms of diabetes?	YES	NO	
	Increased urination	1	0	
	Increased thirst	1	0	
	Jaundice	1	0	
	Weight loss	1	0	
	Diarrhea	1	0	
	High blood sugar level	1	0	
	Weight gain	1	0	
	Increased hunger	1	0	
	Weakness	1	0	
6F	Can diabetes be prevented?	YES…1	NO…0	DON'T KNOW…0
6G	If yes, in which of the following ways do you think it can be prevented?	Yes	No	
	Reducing food portion size	1	0	
	Fruits and vegetables	1	0	
	Reducing food and drinks with sugar	1	0	
	Increased physical activity	1	0	
	Losing weight	1	0	

QUESTIONS AND FILTERS		Response and Score	
	Hospital medication	1	0
	Regular screening for diabetes	1	0
	Maintaining weight	1	0
	Traditional medicine	0	1
		Yes	No
6H	Can Diabetes Mellitus be treated?	0	1

I would like to ask you questions about your attitude towards prevention of T2DM. By attitude I am referring to the way you feel towards the questions I will ask.

SECTION 7: ATTITUDE TOWARDS PREVENTION OF T2DM

		Strongly agree	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly disagree**
7A	I feel that I have little control over risks to my health	**1**	**2**	**3**	**4**	**5**
7B	If I am going to get diabetes mellitus, there is not much I can do about it	**1**	**2**	**3**	**4**	**5**
7C	I think that my personal efforts will help control my risks of getting diabetes	**5**	**4**	**3**	**2**	**1**
7D	People who make a good effort to control the risks of getting diabetes mellitus are much less likely to get diabetes mellitus	**5**	**4**	**3**	**2**	**1**
7E	Compared to other people of my same age, I am less likely than they are to get diabetes mellitus	**1**	**2**	**3**	**4**	**5**
7F	Compared to other people of my same age, I am less likely than they are to get a serious disease	**1**	**2**	**3**	**4**	**5**
7G	Doing regular exercise and following a weight loss diet take a lot of effort	**1**	**2**	**3**	**4**	**5**
7H	Benefits of following a weight loss diet and exercise program outweigh the effort to do it.	**5**	**4**	**3**	**2**	**1**
7I	Regular exercise and diet may prevent diabetes mellitus from developing	**5**	**4**	**3**	**2**	**1**
7J	Diabetes mellitus can be prevented.	**5**	**4**	**3**	**2**	**1**

SECTION 8: PRACTICES RELATED TO T2DM PREVENTION

8.1 PHYSICAL ACTIVITY- MODIFIED STEPS/GPAQ

	The next questions are about the time you spend doing different types of physical activities. This includes activities you do **at home, at work, travelling from place to place and during your spare time**. You are requested to answer the questions even if you don't consider yourself to be an active person.				
	Occupation-Related Physical Activity (paid or unpaid work): When answering the following questions, think back over the **past 12 months** and consider (think of) **a usual week**.				
8.1A	Does your work involve <u>vigorous</u> activities that cause large increases in breathing or heart rate (<u>like</u> heavy lifting, digging, or heavy construction)				
	for **at least 10 minutes** at a time? (Use showcard)			Yes 1	No 0
	If No, go to question 9D				
8.1B	In **a usual week**, how many days do you do <u>vigorous</u> activities as part of your work?				
	DAYS:				
8.1C	On **a usual day** on which you do <u>vigorous</u> activities, how much time do you spend doing such work?				
	1	HOURS:			
	2	MINUTES:			
8.1D	Does your work involve <u>moderate-intensity</u> activities, that causes small increases in breathing or heart rate (<u>like</u> brisk walking or carrying light loads)				
	for **at least 10 minutes** at a time? (use showcards)			Yes 1	No 0
	If No, go to question 8.1G				

8.1E	In **a usual week**, how many days do you do moderate-intensity activities as part of your work?				
	Days:				
8.1F	On **a usual day** on which you do moderate-intensity activities, how much time do you spend doing such work?				
	1	Hours:			
	2	Minutes:			
	Travel-related physical activity: other than activities that you've already mentioned, I would like to ask you about the way you travel to and from places (to work, to shopping, to market, to church, to visit friends and relatives etc.).				
8.1G	Do you walk or use a bicycle (pedal cycle) for **at least 10 minutes** at a time to get to and from places?				
				Yes 1	No 0
	If no, go to question 8.1J				
8.1H	In **a usual week**, how many days do you walk or cycle for at least 10 minutes to get to and from places?				
	Days:				
8.1I	On **a usual day,** how much time do you spend walking or cycling for travel?				
	1	Hours:			
	2	Minutes:			
	Non-work related and leisure time physical activity: the next questions ask about activities you do in your leisure or spare time, for recreation or fitness**.** Do not include the physical activities you do at work or for travel already mentioned.				
8.1J	In your leisure or spare time, do you do any vigorous activities that cause large increases in breathing or heart rate (like running or strenuous				
	Sports like football, weightlifting) for **at least 10minutes** at a time? (use showcards)			Yes 1	No 0
	If no, go to question 8.1M				
8.1K	In **a usual week**, how many days do you do vigorous activities as part of your leisure or spare time?				
	Days:				

8.1L	How much time do you spend doing this on **a usual day?**				
	1	Hours:			
	2	Minutes:			
8.1M	In your leisure or spare time, do you do any moderate-intensity activities that cause a small increase in breathing or heart rate (like brisk walking, volleyball, cycling or				
	Swimming) for **at least 10minutes** at a time? (use showcards)			Yes 1	No 0
	If no, go to question 8.1P				
8.1N	In **a usual week**, how many days do you do moderate-intensity activities as part of your leisure				
	Or spare time? Days:				
8.1O	How much time do you spend doing this on **a usual day?**				
		Hours:			
		Minutes:			
	Sitting / resting activity: now I would like to ask you about the time spent sitting or resting, not including sleeping, **in the past 7 days**. This may include time sitting at a desk, visiting friends, reading, or sitting down to watch television **during working hours and leisure or spare time**.				
8.1P	Over the **past 7 days,** how much time did you spend sitting or reclining (lying) on **a usual day (excluding sleeping)?**				
		Hours:			
		Minutes:			

SECTION 8.2 EATING HABITS

How often and what quantities do you usually eat the following products?

8.2A		**Portion size**	**how many serving portions per meal**	**how many times a day**	**how many days a week**
8.2B	Pap	Serving spoon			
8.2C	Rice/ pasta	Serving spoon			
8.2D	Potatoes	Numbers			
8.2E	Meat	Matchbox size beef/ chicken piece			
8.2F	Take away eg KFC, pizza	Frequency			
8.2G	Bread	A slice			
8.2H	Fruits	One whole fruit, specify			
8.2I	Vegetables	1/2cup			
8.2J	Added sugar	teaspoon			
How much and how often do you normally drink the following? (Tick in one column 1-5)					
		Quantity	How many times per day	How many times per week	How many times per month
8.2K	Soft drinks/fizzy drinks eg coca cola, pepsi, squeeza	330mls glass/ can/ king size			
8.2L	water	250ml cup			
8.2M	Juice with added sugars eg oros,fruitree	500mls			
8.2N	Alcohol beverages	330mls glass			
8.2O	Coffee, tea or beverages with added sugar	250mls cup			

8.3 Screening for T2DM

	QUESTION	CODING CATEGORIES	
8.3A	Have you ever participated in any screening program for diabetes?	Yes….1	No ….0
8.3B	If you were ever screened for diabetes, what was the result of the test?	Diabetes Pre diabetes – slightly elevated blood sugar levels which may progress to T2DM No Diabetes Can't remember	1 2 3 4

Thank you!

Alterations after pilot study was done

In section 3 under family medical history, question 4B was disregarded after piloting as it was seen that most participants did not know about the history of gestational diabetes for their female 1st-degree relatives. Question 5B initially had an option of selecting one source of information, but we noticed participants opted to choose various sources of information so an instruction to select all applicable sources was added. The question which asks if "consuming more sugar-sweetened beverages such as coca-cola and sweetened foods may make one more easily develop T2DM or not" was adjusted and directly translated from siSwati so that participants understood what was meant by excessive sugar consumption. The question, "Can diabetes mellitus be treated?" tended to be confused with the management of diabetes, therefore, during the main interview, it was clarified that treatment referred to the actual cure of the disease.

Appendix 3. GPAQ Showcards

Physical Activity

Examples for vigorous activities at WORK

VIGOROUS Intensity Activities
Make you breathe much harder than normal

Vigorous Physical Activity at Work

Other examples for VIGOROUS activities at WORK	• Forestry (cutting, chopping, carrying wood) • Sawing hardwood • Ploughing • Cutting crops (sugar cane) • Gardening (digging) • Grinding (with pestle) • Labouring (shovelling sand) • Loading furniture (stoves, fridge) • Instructing spinning (fitness) • Instructing sports aerobics • Sorting postal parcels (fast pace) • Cycle rickshaw driving

Moderate Physical Activity at Work

Examples for MODERATE activities at work	**MODERATE Intensity Activities** Make you breathe somewhat harder than normal

Other examples for MODERATE activities at WORK

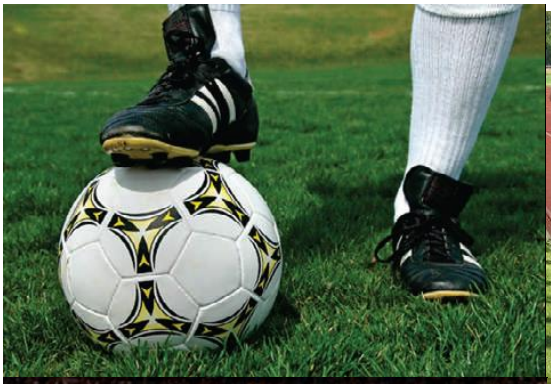
- Cleaning (vacuuming, mopping, polishing, scrubbing, sweeping, ironing)
- Washing (beating and brushing carpets, wringing clothes (by hand)
- Gardening
- Milking cows (by hand)
- Planting and harvesting crops
- Digging dry soil (with spade)
- Weaving
- Woodwork (chiselling, sawing softwood)
- Mixing cement (with shovel)
- Labouring (pushing loaded wheelbarrow, operating jackhammer)
- Walking with load on head
- Drawing water
- Tending animals

Vigorous Physical Activity during Leisure Time

Examples for VIGOROUS activities during LEISURE TIME

VIGOROUS Intensity Activities

Make you breathe <u>much</u> harder than normal



Other examples for VIGOROUS activities during LEISURE TIME

- Soccer
- Rugby
- Tennis
- High-impact aerobics
- Aqua aerobics
- Ballet dancing
- Fast swimming

Moderate Physical Activity during Leisure Time

Examples for MODERATE activities during LEISURE TIME

MODERATE Intensity Activities

Make you breathe somewhat harder than normal




Other examples for MODERATE activities at WORK

- Cycling
- Jogging
- Dancing
- Horse-riding
- Tai chi
- Yoga
- Pilates
- Low-impact aerobics
- Cricket

*Activities VI. Physical Activity Vigorous Physical Activity at Work Moderate Physical Activity at Work.

Appendix 4. Participant consent form

Participant code	

SIGNATURE OF RESEARCH SUBJECT OR LEGAL REPRESENTATIVE

The information above was described to me by
……...
(Investigator's name)
in……..(Language) and I am/the subject is/the participant is] in command of this language or it was satisfactorily translated to me. I was given the opportunity to ask questions and these questions were answered to m y satisfaction.
I understand that taking part in this study is voluntary and I have been given a copy of this form.

Name of Subject/Participant
Name of Legal Representative (if applicable)

_____ _____
Signature of Subject/Participant or Legal Representative Date

SIGNATURE OF INVESTIGATOR

I declare that I explained the information given in this document to _____ [name of the subject/participant] and/or [his/her] representative _____ [name of the representative]. [He/she] was encouraged and given ample time to ask me any questions. This conversation was conducted in English.

_____
Signature of Investigator Date

Appendix 5. Ethical Approval

Approved with Stipulations New Application

26/09/2018
Project ID: **7861**
HREC Reference #: S18/08/160
Title: Knowledge, attitude and practices regarding prevention of Type 2 Diabetes Mellitus

Dear Mrs Karen Chideme- Chinovhiringa

The **New Application** received on 17/08/2018 16:20 was reviewed by members of the **Health Research Ethics Committee** via Minimal Risk Review procedures on 26/09/2018 and was approved with stipulations.

Please note the following information about your approved research protocol**:** Protocol Approval Period: **05-Sep-2018 – 04-Sep-2019.**
The stipulations of your ethics approval are as follows:
Date of birth of participants should be removed from data sheet if not relevant.

Please remember to use your **project ID 7861** and ethics reference number on any documents or correspondence with the HREC/UREC concerning your research protocol.

Translation of the consent document(s) to the language(s) applicable to your study participants should now be submitted to the HREC.

Please note that this decision will be ratified at the next HREC full committee meeting. HREC reserves the right to suspend approval and to request changes or clarifications from applicants. The coordinator will notify the applicant (and if applicable, the supervisor) of the changes or suspension within 1 day of receiving the notice of suspension from HREC. HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:

Please note you can submit your progress report through the online ethics application process, available at: https://apply.ethics.sun.ac.za and the application should be submitted to the Committee before the year has expired. Please see Forms and Instructions on our HREC website for guidance on how to submit a progress report.

The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility, permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Please consult the Western Cape Government website for access to the online Health Research Approval Process, see: https://www.westerncape.gov.za/general-publication/health-research-approval-process. Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.

For standard HREC forms and instructions, please visit: Forms and Instructions on our HREC website (www.sun.ac.za/healthresearchethics)

If you have any questions or need further assistance, please contact the HREC office at 021 938 9677.

Yours sincerely,
Mr. Franklin Weber HREC Coordinator

National Health Research Ethics Council (NHREC) Registration Number: REC-130408-012 (HREC1)·REC-230208-010 (HREC2)

Federal Wide Assurance Number: 00001372
Office of Human Research Protections (OHRP) Institutional Review Board (IRB) Number: IRB0005240 (HREC1)·IRB0005239 (HREC2)

The Health Research Ethics Committee (HREC) complies with the SA National Health Act No. 61 of 2003 as it pertains to health research. The HREC abides by the ethical norms and principles for research, established by the World Medical Association (2013). Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects; the South African Department of Health (2006). Guidelines for Good Practice in the Conduct of Clinical Trials with Human Participants in South Africa (2nd edition); as well as the Department of Health (2015). Ethics in Health Research: Principles, Processes and Structures (2nd edition).

The Health Research Ethics Committee reviews research involving human subjects conducted or supported by the Department of Health and Human Services, or other federal departments or agencies that apply the Federal Policy for the Protection of Human Subjects to such research (United States Code of Federal Regulations Title 45 Part 46); and/or clinical investigations regulated by the Food and Drug Administration (FDA) of the Department of Health and Human Services.

Appendix 6. Kingdom of Eswatini (Ethical clearance)

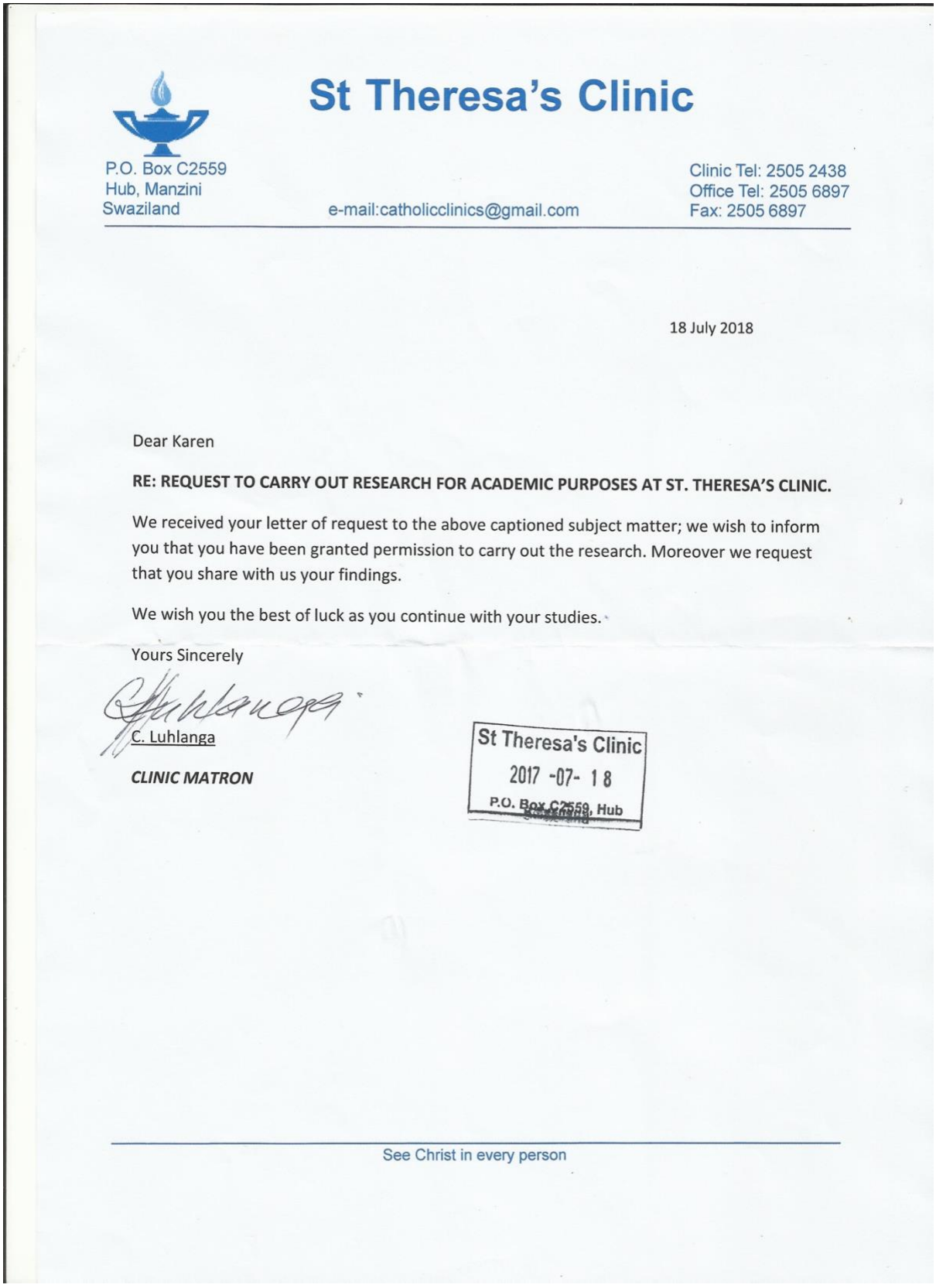
RESEARCH PROTOCOL CLEARANCE CERTIFICATE

BOARD REGISTRATION NUMBER	**FWA 00026661/IRB 00011253**							
PROTOCOL REFERENCE NUMBER	**SHR129/2019**							
Type of Review	Expedited	X		Full Board				
Name of Organization	**STUDENT (Masters)**							
Title of study	**Knowledge, attitudes and practices regarding prevention of type 2 diabetes mellitus among overweight and obese adults.**							
Protocol version	**1.0**							
Nature of protocol	New	X		Amendment		Renewal		
List of study sites	**St Theresa's Clinic**							
Name of Principal Investigator	**Ms. Chinovhiringa, Karen**							
Names of Co- Investigators	**N/A**							
Names of steering committee members in the case of clinical trials	**N/A**							
Names of Data and Safety Committee members in the case of clinical trials	**N/A**							
Level of risk (Tick appropriate box)	Minimal ✓			High				
Clearance status (Tick appropriate box)	Approved	X		Disapproved				
Clearance validity period	Start date	**29/05/2019**		End date	**29/05/2020**			
Signature of Chairperson								
Date of signing	**29/05/2019**							
Secretariat Contact Details	Name of contact officers		**Ms Babazile Shongwe**					
	Email address		babazileshongwe@gmail.com					
	Telephone no.		**(00268) 24040865/24044905**					

MINISTRY OF HEALTH
29 MAY 2019
HEALTH RESEARCH REVIEW BOARD
SWAZILAND

Page **1** of **2**

Appendix 7. Clinic Approval Letter



St Theresa's Clinic

P.O. Box C2559
Hub, Manzini
Swaziland

e-mail:catholicclinics@gmail.com

Clinic Tel: 2505 2438
Office Tel: 2505 6897
Fax: 2505 6897

18 July 2018

Dear Karen

RE: REQUEST TO CARRY OUT RESEARCH FOR ACADEMIC PURPOSES AT ST. THERESA'S CLINIC.

We received your letter of request to the above captioned subject matter; we wish to inform you that you have been granted permission to carry out the research. Moreover we request that you share with us your findings.

We wish you the best of luck as you continue with your studies.

Yours Sincerely

C. Luhlanga

CLINIC MATRON

St Theresa's Clinic
2017 -07- 18
P.O. Box C2559, Hub

See Christ in every person

Appendix 8. PLOS ONE Author guidelines

Submission Guidelines

PLOS Medicine publishes original research articles of outstanding medical importance. We will consider manuscripts of any length; we encourage the submission of both substantial full-length bodies of work and shorter manuscripts that report novel findings that might be based on a more limited range of experiments.

The writing style should be concise and accessible, avoiding jargon so that the paper is understandable for readers outside a specialty or those whose first language is not English. Editors will make suggestions for how to achieve this, as well as suggestions for deletions or additions that could be made to the article to strengthen the argument. Our aim is to make the editorial process rigorous and consistent, but not intrusive or overbearing. Authors are encouraged to use their own voice and to decide how best to present their ideas, results, and conclusions.

PLOS Medicine is committed to the highest ethical standards in medical research. Accordingly, we ask authors to provide specific information regarding ethical treatment of research participants, patient consent, patient privacy, protocols, authorship, and competing interests. We also ask that reports of certain specific types of studies adhere to generally accepted standards. Our requirements are based on the Uniform Requirements for Manuscripts Submitted to Biomedical Journals, issued by the International Committee for Medical Journal Editors.

Related information for authors

Submission system
Journal scope and publication criteria
Getting started guide
Guidelines for magazine submissions
Guidelines for revisions
Publication fees

Style and Format

File format	Submit the manuscript file in DOC, DOCX, RTF, or PDF format. Your file should not be locked or protected. If you have written your manuscript in LaTeX, please submit as a PDF. Read the LaTeX guidelines.
Length	Manuscripts can be any length. There are no restrictions on word count, number of figures, or amount of supporting information. We encourage you to present and discuss your findings concisely.
Font	Use a standard font size and any standard font, except for the font named “Symbol”. To add symbols to the manuscript, use the Insert → Symbol function in your word processor or paste in the appropriate Unicode character.
Headings	Limit manuscript sections and sub-sections to 3 heading levels. Make sure heading levels are clearly indicated in the manuscript text.
Layout and spacing	Manuscript text should be double-spaced. Do not format text in multiple columns.
Page and line numbers	Include page numbers and line numbers in the manuscript file. Use continuous line numbers (do not restart the numbering on each page).
Footnotes	Footnotes are not permitted. If your manuscript contains footnotes, move the information into the main text or the reference list, depending on the content.
Language	Manuscripts must be submitted in English. You may submit translations of the manuscript or abstract as supporting information. Read the supporting information guidelines.
Abbreviations	Define abbreviations upon first appearance in the text. Do not use non-standard abbreviations unless they appear at least three times in the text. List all non-standard abbreviations (with definitions) in alphabetical order in a separate section at the beginning of the manuscript. Keep abbreviations to a minimum.
Reference style	PLOS uses “Vancouver” style, as outlined in the ICMJE sample references. See reference formatting examples and additional instructions below.
Equations	We recommend using MathType for display and inline equations, as it will provide the most reliable outcome. If this is not possible,

<table>
<tr><td></td><td>Equation Editor or Microsoft's Insert→Equation function is acceptable. Please do not embed equations as images.
Avoid using MathType, Equation Editor, or the Insert→Equation function to insert single variables (e.g., “a² + b² = c²”), Greek or other symbols (e.g., β, Δ, or ′ [prime]), or mathematical operators (e.g., x, ≥, or ±) in running text. Wherever possible, insert single symbols as normal text with the correct Unicode (hex) values.
Do not use MathType, Equation Editor, or the Insert→Equation function for only a portion of an equation. Rather, ensure that the entire equation is included. Equations should not contain a mix of different equation tools. Avoid “hybrid” inline or display equations, in which part is text and part is MathType, or part is MathType and part is Equation Editor.</td></tr>
<tr><td>Nomenclature</td><td>Use correct and established nomenclature wherever possible.
<table>
<tr><td>Units of measurement</td><td>Use SI units. If you do not use these exclusively, provide the SI value in parentheses after each value. Read more about SI units.</td></tr>
<tr><td>Drugs</td><td>Provide the Recommended International Non-Proprietary Name (rINN).</td></tr>
<tr><td>Species names</td><td>Write in italics (e.g., Homo sapiens). Write out in full the genus and species, both in the title of the manuscript and at the first mention of an organism in a paper. After first mention, the first letter of the genus name followed by the full species name may be used (e.g., H. sapiens).</td></tr>
<tr><td>Genes, mutations, genotypes, and alleles</td><td>Write in italics. Use the recommended name by consulting the appropriate genetic nomenclature database (e.g., HGNC for human genes; we strongly recommend using this tool to check against previously approved names). It is sometimes advisable to indicate the synonyms for the gene the first time it appears in the text. Gene prefixes such as those used for oncogenes or cellular localization should be shown in roman typeface (e.g., v-fes, c-MYC).</td></tr>
<tr><td>Allergens</td><td>The systematic allergen nomenclature of the World Health Organization/International Union of Immunological Societies (WHO/IUIS) Allergen Nomenclature Sub-committee should be used for manuscripts that include the description or use of allergenic proteins. For manuscripts describing new allergens, the systematic</td></tr>
</table></td></tr>
</table>

		name of the allergen should be approved by the WHO/IUIS Allergen Nomenclature Sub-committee prior to manuscript publication. Examples of the systematic allergen nomenclature can be found at the WHO/IUIS Allergen Nomenclature site.

Manuscript Organization
Most manuscripts should be organized as follows. Instructions for each element appear below.
Title
Authors
Affiliations
Abstract
Introduction
Methods (or Methods and Materials)
Results
Discussion
Acknowledgments
References
Supporting information captions
Other elements

Upon editorial acceptance, figure files should be uploaded separately from the manuscript, and each figure caption should be inserted in read order after the first paragraph where the figure is cited. Read more information about our figure requirements during each stage of editorial review.

Tables are inserted immediately after the first paragraph in which they are cited. Supporting information files are uploaded separately.

Parts of a Submission
Title
Include a full title and a short title for the manuscript.

Title	Length	Guidelines	Examples
Full title	200 characters	Specific, descriptive, concise, and comprehensible to readers outside the field	Impact of cigarette smoke exposure on innate immunity: A *Caenorhabditis elegans* model Solar drinking water disinfection (SODIS) to reduce childhood diarrhoea in rural Bolivia: A cluster-randomized, controlled trial
Short title	70 characters	State the topic of the study	Cigarette smoke exposure and innate immunity SODIS and childhood diarrhoea

Titles should be written in sentence case (only the first word of the text, proper nouns, and genus names are capitalized). Avoid specialist abbreviations if possible. For clinical trials, systematic reviews, or meta-analyses, the subtitle should include the study design.

Author list

Authorship requirements
All authors must meet the criteria for authorship as outlined in the authorship policy. Those who contributed to the work but do not meet the criteria for authorship can be mentioned in the Acknowledgments. Read more about Acknowledgments.

The corresponding author must provide an ORCID iD at the time of submission by entering it in the user profile in the submission system. Read more about ORCID.

Author names and affiliations
Enter author names on the title page of the manuscript and in the online submission system.
On the title page, write author names in the following order:
First name (or initials, if used)
Middle name (or initials, if used)
Last name (surname, family name)
Each author on the list must have an affiliation. The affiliation includes department, university, or organizational affiliation and its location, including city, state/province (if applicable), and country. Authors have the option to include a current address in addition to the address of their affiliation at the time of the study. The current address should be listed in the byline and clearly labeled “current address.” At a minimum, the address must include the author’s current institution, city, and country.
If an author has multiple affiliations, enter all affiliations on the title page only. In the submission system, enter only the preferred or primary affiliation. Author affiliations will be listed in the typeset PDF article in the same order that authors are listed in the submission.
Author names will be published exactly as they appear in the manuscript file. Please double-check the information carefully to make sure it is correct.

Corresponding author
The submitting author is automatically designated as the corresponding author in the submission system. The corresponding author is the primary contact for the journal office and the only author able to view or change the manuscript while it is under editorial consideration.
The corresponding author role may be transferred to another coauthor. However, note that transferring the corresponding author role also transfers access to the manuscript. (To designate a new corresponding author while the manuscript is still under consideration, watch the video tutorial below.)
Only one corresponding author can be designated in the submission system, but this does not restrict the number of corresponding authors that may be listed on the article in the event of publication. Whoever is designated as a corresponding author on the title page of the manuscript file will be listed as such upon publication. Include

an email address for each corresponding author listed on the title page of the manuscript.

Consortia and group authorship
If a manuscript is submitted on behalf of a consortium or group, include its name in the manuscript byline. Do not add it to the author list in the submission system. You may include the full list of members in the Acknowledgments or in a supporting information file.
PubMed only indexes individual consortium or group author members listed in the article byline. If included, these individuals must qualify for authorship according to our criteria.
Read the group authorship policy.

Author contributions
Enter all author contributions in the submission system, and use the CRediT taxonomy to describe each contribution. Read the policy and the full list of roles.
To qualify for authorship, all contributors must meet at least one of the seven core contributions (conceptualization, methodology, software, validation, formal analysis, investigation, data curation), as well as at least one of the writing contributions (original draft preparation, review and editing). Authors may also satisfy the other remaining contributions; however, these alone will not qualify them for authorship. Contributions will be published with the final article, and they should accurately reflect contributions to the work. The submitting author is responsible for completing this information at submission, and we expect that all authors will have reviewed, discussed, and agreed to their individual contributions ahead of this time.

All authors will be contacted via email at submission to ensure that they are aware of and approve the submission of the manuscript, its content, authorship, and order of authorship. Articles will not be published unless all authors have provided their assent to publication.

Cover letter
Upload a cover letter as a separate file in the online system.
The cover letter should address the following questions:
Why is this manuscript suitable for publication in *PLOS Medicine*?
Why will your study inspire researchers or clinicians, and how will it improve patient care or public health, or drive the understanding of disease forward?

Title page
The title, authors, and affiliations should all be included on a title page as the first page of the manuscript file.

Abstract
The Abstract comes after the title page in the manuscript file. The abstract text is also entered in a separate field in the submission system.
The research article Abstract is divided into the following three sections: Background, Methods and Findings, and Conclusions. It should contain all the following elements (items in square brackets are needed only for some study types).

Please use the same format for abstracts submitted as presubmission inquiries. *PLOS Medicine* prefers abstract submissions not exceed 300 words, with a maximum of 500 words allowed.

Background
This section should clearly describe the rationale for the study. It should end with a statement of the specific study hypothesis and/or study objectives.

Methods and Findings
Describe the study participants or what was studied (e.g., patient population, cell lines; be as specific as possible, including numbers of individuals studied). Describe the study design, intervention if applicable, main methods used, primary outcome measure(s), and length of follow up if applicable.
[If appropriate, include how many participants were assessed out of those enrolled. For survey research, include the response rate.]
[If critical to the understanding of the paper, describe how results were analyzed, i.e., which specific statistical tests were used.]
Describe the main outcomes and quantify the results using a measure of precision (e.g., 95% confidence interval). Describe any adverse events.
Describe the main limitations of the study.

Conclusions
Provide a general interpretation of the results with any important recommendations for future research.

[For a clinical trial, provide any trial identification number(s) and name(s) (e.g., trial registration number, protocol number or acronym).]
The Introduction should put the focus of the manuscript into a broader context. As you compose the Introduction, think of readers who are not experts in this field. Include a brief review of the key literature. If there are relevant controversies or disagreements in the field, they should be mentioned so that a non-expert reader can delve into these issues further. The Introduction should conclude with a brief statement of the overall aim of the experiments and a comment about whether that aim was achieved.

The Methods should provide enough detail for reproduction of the findings. Protocols for new methods should be included, but well-established methodological procedures may simply be referenced. A full description of the methods should be included in the manuscript itself rather than in a supplemental file.
Methods should also include a section with descriptions of any statistical methods used. The description should conform to the criteria outlined by the Uniform Requirements, as follows:

Describe statistical methods with enough detail to enable a knowledgeable reader with access to the original data to judge its appropriateness for the study and to verify the reported results. When possible, quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Avoid relying solely on statistical hypothesis testing, such as P values, which fail to convey important information about effect size and precision of

estimates. References for the design of the study and statistical methods should be to standard works when possible (with pages stated). Define statistical terms, abbreviations, and most symbols. Specify the statistical software package(s) and versions used. Distinguish prespecified from exploratory analyses, including subgroup analyses.
Submit detailed protocols for newer or less established methods. Well-established protocols may simply be referenced. Protocol documents for clinical trials, observational studies, and other **non-laboratory** investigations may be uploaded as supporting information.

We recommend and encourage you to deposit **laboratory protocols** in protocols.io, where protocols can be assigned their own persistent digital object identifiers (DOIs).
To include a link to a protocol in your article:
Describe your step-by-step protocol on protocols.io
Select **Get DOI** to issue your protocol a persistent digital object identifier (DOI)
Include the DOI link in the Methods section of your manuscript using the following format provided by protocols.io: http://dx.doi.org/10.17504/protocols.io.[PROTOCOL DOI]
At this stage, your protocol is only visible to those with the link. This allows editors and reviewers to consult your protocol when evaluating the manuscript. You can make your protocols public at any time by selecting **Publish** on the protocols.io site. Any referenced protocol(s) will automatically be made public when your article is published.

Results
The Results section should include all primary and secondary outcome measures analyzed. The section may be divided into subsections, each with a concise subheading. Tables and figures central to the study should be included in the main paper. The Results section should be written in past tense.
PLOS journals require authors to make all data underlying the findings described in their manuscript fully available without restriction, with rare exception.
Large data sets, including raw data, may be deposited in an appropriate public repository. See our list of recommended repositories.
For smaller data sets and certain data types, authors may provide their data within Supporting Information files accompanying the manuscript. Authors should take care to maximize the accessibility and reusability of the data by selecting a file format from which data can be efficiently extracted (for example, spreadsheets or flat files should be provided rather than PDFs when providing tabulated data).
For more information on how best to provide data, read our policy on data availability. PLOS does not accept references to "data not shown."
As outlined in the Uniform Requirements:

Give numeric results not only as derivatives (for example, percentages) but also as the absolute numbers from which the derivatives were calculated, and specify the statistical significance attached to them, if any. Restrict tables and figures to those needed to explain the argument of the paper and to assess supporting data. Use graphs as an alternative to tables with many entries; do not duplicate data in graphs and tables. Avoid nontechnical uses of technical terms in statistics, such as "random

”(which implies a randomizing device), “normal,” “significant,” “correlations,”and “ sample.”

Discussion

The Discussion should be concise and tightly argued. It should start with a brief summary of the main findings. It should include paragraphs on the generalizability, clinical relevance, strengths, and limitations of your study.

You may wish to discuss the following points also:

How do the conclusions affect the existing knowledge in the field?

How can future research build on these observations and what are the key experiments that must be done?

Acknowledgments

Those who contributed to the work but do not meet our authorship criteria should be listed in the Acknowledgments with a description of the contribution.

Authors are responsible for ensuring that anyone named in the Acknowledgments agrees to be named.

PLOS journals publicly acknowledge the indispensable efforts of our editors and reviewers on an annual basis. To ensure equitable recognition and avoid any appearance of partiality, do not include editors or peer reviewers—named or unnamed—in the Acknowledgments.